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Short Communication

Emotional and sensory profiling of insect-, plant- and meat-based burgers under blind, expected and informed conditions



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ABSTRACT

The use of edible insects as a potential component of food products is gathering interest among scientists, policy makers and the food industry. Although recent research suggests that a growing number of Western consumers might be willing to consume food products containing edible insects or insect-based protein, little is known about the influence of ingredient information on product evaluation. The aim of this study was to examine (i) the overall liking, perceived quality and nutritiousness, and (ii) the emotional and sensory profiling of three commercially available burgers (insect-based, plant-based and meat-based), under blind, expected and informed conditions. In total, 97 young adults took part in this experiment, divided into two sessions to assess the effect of blind tasting. The findings of the study revealed that although the overall liking for the insect burger was comparable to the liking for the plant-based burger, further product development is needed to improve its sensory quality. Complete assimilation occurred for the insect-based burger, which shows that information influenced overall liking. In addition, the informed condition had little influence on emotional conceptualisations. Future research should further explore different informational strategies in order to obtain a better understanding on Western consumers' evaluation of insect-based products.

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1. Introduction

There is a growing interest in edible insects as a feed and food source across the world, mainly for their potential contribution towards ensuring global feed and food security for future decades (FAO, 2013). Several advantages of using insects in feed and food have been reported by the FAO. These include feed conversion efficiency, greenhouse gas and ammonia emissions, water use, and animal welfare. Besides the positive effects on the environment, edible insects are also considered a valuable food product with an adequate nutritional composition.

Although it is estimated that around 2 billion people regularly consume edible insects, an issue which has often been reported is the rather limited consumer acceptance in Western countries (van Huis, 2013). Studies have identified several reasons for consumers' aversion towards food products containing edible insects, such as health and safety concerns (e.g. unsafe and linked with diseases), negative sensory perceptions (e.g. flavour,

appearance, texture), entrenched attitudes (e.g. about sustainability), and cultural influence (e.g. edible insects might be classified as pest insects) (Tan et al., 2015; van Huis, 2013). Several food products containing edible insects have recently been launched in Europe. However, little is currently known about how consumers evaluate and experience such products.

To address this gap, it is necessary to explore the sensory experience beyond blind evaluation and also to include expected and informed evaluations of food products (Meiselman, 2013). It is well known that extrinsic factors, such as content information relating to nutritional composition, brands, or packaging could influence sensory evaluation when a discrepancy occurs between the expected and actual food experience (Piqueras-Fiszman & Spence, 2015). Four main psychological theories (Piqueras-Fiszman & Spence, 2015) could explain the different outcomes of the so-called disconfirmation effect: (1) assimilation theory depicts that product evaluation ratings shift towards prior expectations; (2) contrast theory applies when one magnifies the discrepancy, which leads to ratings shifting in the opposite direction instead; (3) generalized negativity theory applies when product ratings are always lower, as participants evaluate the product negatively due to it not

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meeting their prior expectations; (4) assimilation/contrast effect theory is involved when an assimilation effect is observed if there is only a small disconfirmation, while the contrast effect is detected if the discrepancy is too large.

Next to hedonic measurements, a growing number of studies also include the measurement of emotional conceptualisations of food products by consumers (Jiang, King, & Prinyawiwatkul, 2014). Such measurements provide additional information to discriminate between food products, even when overall acceptance is similar (Jiang et al., 2014) and improve food choice prediction (Dalenberg et al., 2014). Furthermore, the assessment of sensory attributes by consumers could also provide additional information about how consumers perceive food products (Moussaoui & Varela, 2010).

The main objective of this study is to investigate and compare the acceptance of a food product containing edible insects as an alternative to meat- and plant-based products, by young adults. To obtain a broader perspective of consumers' food product experience, emotional and sensory profiling have been included and products have been evaluated under blind, expected (based on provided content information) and informed conditions.

2. Materials and methods

2.1. Experimental design

Participants were asked to evaluate three burgers and express their overall liking, perceived quality, perceived nutritiousness and EmoSensory[®] profile (Schouteten et al., 2015). This recently introduced tool uses a wheel format to obtain both emotional and sensory profiles of products by consumers. Here, consumers evaluated the products under three different conditions:

- Blind condition (tasting): consumers were asked to evaluate the unbranded products in order to study the effect of the sensory attributes.
- Expected condition (no tasting): consumers were presented with the main composition of the burgers in order to study the effect of composition information. The insect-, plant- and meat-based burgers were presented as 'burger prepared with insects', 'vegetarian burger', and 'burger prepared with meat', respectively.
- Informed condition (tasting): consumers were asked to evaluate the products when they also had information about the main composition ingredient, in order to study the combined effect of the sensory attributes and the composition information.

The expected and informed conditions were assessed during the same (i.e. the second) session, which is a similar design to the one used by Spinelli, Masi, Zoboli, Prescott, and Monteleone (2015).

2.2. Participants

A total of 97 consumers took part in this experiment. The study participants were young adult volunteers who were recruited close to the university campus. Fifty-three participants (mean age 27 years old, 64% male) evaluated the products under each of the three conditions during two sessions (first consumer sample). Six participants were unwilling to taste the insect-based burgers during the informed session and their data have therefore been excluded from the data analysis. In addition, 38 consumers only participated in the second session, and thus were only exposed to the expected and informed conditions (second consumer sample). Their data were used to examine whether prior tasting had an influence on the overall liking under the informed condition.

2.3. Samples

The authors have opted to examine burgers in which the insects were not visible, as previous studies have shown that more participants are willing to consume insect foods if the product is familiar and has a low ingredient visibility (Tan et al., 2015). Three burgers were selected for this study and all were commercially available. The plant-based burger ('Garden Gourmet' brand) contained 19% vegetable protein (soy and wheat) while the meat-based burger ('Beckers' brand) consisted of 80% meat (71% chicken and 9% pork). The insect-based burger ('BenSBugs' brand) contained 31% mealworms. The number of products was limited to three burgers based on previous suggestions for emotional research by King, Meiselman, and Carr (2013). All burgers were bought in frozen condition to ensure a similar sensory quality during the two different sessions. Burgers were prepared according to the instructions provided on the package and each participant was served a sample sufficient for two to three bites. Samples were monadically served in transparent containers following a randomized complete block design. Products were coded using a random 3-digit number.

2.4. Procedure

Consumer tests were carried out at sensory facilities at Ghent University using EyeQuestion 3.14.0 (Logic8 BV). Participants for the three conditions (first consumer sample) attended two sessions, with two to three weeks between the sessions depending on the participant's availability. Consumer tests for the second consumer sample took place in the same time period as the second session for the first consumer sample.

During the first session, participants tasted each product blind and then rated overall liking (9-point scale), quality (7-point scale), nutritiousness (7-point scale) and assessed the emotional and sensory profile using the EmoSensory[®] Wheel questionnaire format (using a 5-point RATA scale). Emotional and sensory terms were determined during blind, expected and informed conditions using the two-step procedure described by Schouteten et al. (2015). The 14 emotional terms included were: contented, disappointed, discontented, disgust, dissatisfied, distrust, energetic, fear, glad, happy, merry, pleasant surprise and worried. The following terms were used for the sensory characterisation of the burgers: after-taste, brown colour, dry, granular, homogeneous, juicy, meat aroma, meat flavour, nutty flavour, off-flavour, salty, soft.

In the second session, participants first completed the expected condition in which they assessed expected overall liking, quality and perceived nutritiousness for the three burgers, e.g. 'how much do you expect to like a vegetarian burger'. The label 'burger prepared with insects' was accompanied by the statement 'Insects are a good source of high-value proteins, their production requires little space, their feed conversion is efficient, and therefore eating insects provides benefits in terms of sustainability. Also, edible insects have been approved for human consumption by the Federal Agency for the Safety of the Food Chain (FAVV) in 2014 in Belgium' as suggested by previous research (van Huis, 2013; Verbeke, 2015). Furthermore, participants were asked which emotional conceptualisations they associate with the labelled burgers. After the expected condition, there was a short break (10 min) foreseen before participants were asked to taste the labelled burgers and evaluate their overall liking, quality, perceived nutritiousness and EmoSensory[®] profiling.

2.5. Data analysis

Repeated measures ANOVA was performed to blind, expected and informed liking, perceived quality and perceived nutritiousness scores to determine whether products were evaluated as different

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